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ASA GRAY.

Asa Gray was born on November 18, 1810, in Sauquoit Valley in the township of Paris, Oneida Co., N. Y., and died on January 30, 1888, at Cambridge, Mass. On the paternal side he was descended from a Scotch-Irish family who emigrated to this country in the early part of the last century. His grandfather, Moses Wiley Gray, was born at Worcester, Mass., December 31, 1745, and was married in 1769 to Sallie Miller. He went in 1787 to Vermont, where his wife soon afterwards died; and when their son Moses, the father of Asa Gray, was eight years old, the father and son moved still farther west, to Sauquoit Valley, then almost a frontier settlement. Sixteen years later, Moses Gray was married to Roxana Howard, a daughter of Joseph Howard, of English descent, who, leaving his home in Massachusetts, had settled in Sauquoit Valley the same year as the Gray family. Of their family of eight children, five sons and three daughters, Asa was the first-born.

When a boy he assisted his father in the smaller duties connected with his farm and tannery; but at an early age he showed a much greater fondness for reading than for farm-work, and the father soon came to the conclusion that his son would make a better scholar than farmer. Until he was about twelve years old, the only education he received was what could be obtained for a part of the year in the small district school, and in the small private school at Sauquoit taught by the son of the parish pastor. He was then sent to the grammar school at Clinton, N. Y., where he remained for two years; and when, in the autumn of 1825, his teacher, Mr. Charles Avery, accepted a place in Fairfield Academy, young Gray followed his instructor to that place, where for four years he pursued elementary mathematical and classical studies. Connected with the Fairfield Academy was a Medical School which enjoyed a high reputation, and was attended by two hundred students, a large number for that time. Dr. James Hadley, the Professor of Materia Medica and Chemistry in the Medical School, also gave some instruction in the Academy, and it was probably through his influence that Gray's attention was first strongly drawn towards natural science. Apparently, he was not at first so much interested in plants as in minerals; and it was not until towards the close of his course in the Academy that his passion for plants was aroused by reading the article on Botany in the Edinburgh Encyclopædia, and his delight the following spring at being able to make out with the aid of Eaton's Manual the scientific name of the common *Claytonia* is now a well known story.

Following his father's wish, which probably was in accord with his own inclination, he decided to study medicine, and formally entered the Fairfield Medical School in 1829, although for two years previously, while a student in the Academy, he had attended some of the medical lectures. The sessions of the Medical School, like those of the Academy, hardly occupied more than six months of the year, and the remainder of the time was spent in study with different physicians in the neighborhood of Sauquoit, one of whom, Dr. John F. Trowbridge of Bridgewater, was a man of good scientific attainments. He was thus in an excellent position for collecting, and even before he graduated he had brought together a considerable herbarium, and had entered into correspondence with Dr. Lewis C. Beck of Albany, and Dr. John Torrey of New York, who aided him in the determination of his plants. He received his Doctor's degree at Fairfield on February 1, 1831. He never, however, entered upon the practice of medicine; but after receiving his degree he became instructor in chemistry, mineralogy, and botany in Bartlett's High School at Utica, N. Y., and taught those subjects, for a part of the year, from the autumn of 1831 to 1835.

The first actual record of any public lectures on botany given by him is found in a circular of the Fairfield Medical School, dated January, 1832, in which the following statement is made: "Asa Gray, M.D., will give a course of lectures and practical illustrations on botany, to commence [in June] and continue the same time with the lectures on chemistry [six weeks]. Fee, $4.00." This course was attended apparently by ten persons; for he states that he spent the $40 earned from these lectures in making a botanical excursion to Niagara Falls. It appears to be the case, however, that in the previous year, just after graduation, he had given a few lectures on botany in the Medical School, in the absence of the regular instructor, Dr. Beck; and a little later, he gave another course of lectures on mineralogy and botany at Hamilton College, Clinton. During other intermissions of his work at Bartlett's School, he made mineralogical and botanical excursions to different parts of New York and New Jersey; and it was while living at Utica that he published in the American Journal of Science of October, 1833, his first scientific paper on new mineral localities in Northern New York, written in connection with Dr. J. B. Crawe.

In the autumn of 1833, having leave of absence from Bartlett's School, he accepted the position of assistant to Professor John Torrey, in the chemical laboratory of the Medical School of New York. His time was here mainly occupied in botanical studies; and, besides aiding Dr. Torrey in his botanical work, he prepared and published several original papers of his own, of which his memoir on *Rhynchospora* may be said to be his first contribution to descriptive botany. His connection with Bartlett's School ended early in 1835, and, although the financial condition of the New York Medical School did not permit his continuing as assistant of Dr. Torrey, he returned to New York in the autumn of 1835, and accepted the position of curator and librarian of the Lyceum of Natural History, — a position which gave him leisure for continuing his botanical studies, and to prepare his first text-book, "Elements of Botany," which appeared in 1836.

About this time a Government expedition, since known as the Wilkes Exploring Expedition, was fitting out, and the position of botanist of the expedition was offered to Dr. Gray in the summer of 1836. The expedition did not sail, however, until two years later; and meanwhile, wearied by the numerous delays and uncertainties about the management of the expedition, Dr. Gray resigned his position and settled in New York, where, in company with Dr. Torrey, he worked energetically on the preparation of the earlier parts of the "Flora," of which the first two parts appeared in October, 1838. While occupied in this work, a new State University had been founded in Michigan, and Dr. Gray accepted the chair of botany which was offered to him, with the understanding that he should be allowed to spend a year abroad in study before beginning his official duties.

The elaboration of the new "Flora" made it necessary for him to examine the types of American plants in foreign herbaria; and in November, 1838, he started on the journey which was not only to give him the means of clearing up much of the existing confusion with regard to the identity of previously described North American species, but, what was more important, was to bring him into close scientific and social relations with the botanical lights of a generation now long past, and with those who were then the young men of promise, a brilliant group, of which Sir J. D. Hooker and A. De Candolle are now almost the only survivors.

He returned to America in November, 1839, but never assumed the duties of Professor at Michigan. He was absorbed in his work on the "Flora," and, refreshed and stimulated by what he had seen and heard abroad, he was pushing rapidly ahead with the second volume, of which he wrote the greater portion, and at the same time printing a "Botanical Text-Book," which was to form the basis of his many subsequent text-books, when he was invited to Cambridge to fill the newly endowed chair of the Fisher Professorship of Natural History in Harvard College.

He accepted, and in 1842 took up his residence in Cambridge. The second volume of the "Flora" was completed the following year. He was at once favorably received in learned and social circles of Cambridge and Boston; and when delivering a course of lectures at the Lowell Institute, he first became acquainted with Miss Jane Lathrop Loring, daughter of Mr. Charles Greely Loring of Boston, to whom he was married on May 4, 1848. From this time his energies were devoted to building up a botanical establishment at Cambridge, — for what was in existence before 1842 hardly deserves mention, — and to the completion of a "Flora of North America." The number of collectors and explorers had by this time greatly increased; and the material they had brought together contained so much that was new, that it was plain that the original plan of the "Flora" must be changed, for the two volumes already published had hardly appeared when a revision seemed necessary. It was not until many years later, in 1878, that the first part of the new "Flora" appeared; and he continued to labor toward the completion of his great work until death forced him to relinquish the unfinished task.

He continued in the exercise of the active duties of lecturer and instructor until 1872, when he was relieved of this charge by the appointment of a colleague, Prof. G. L. Goodale; but he gave occasional lectures in the College for a few years longer. In 1873 he resigned his office of Director of the Botanic Garden, and Prof. C. S. Sargent was appointed his successor. He retained the title of Fisher Professor and Director of the Herbarium until his death, although he was in part relieved of the responsibilities of the latter position by the appointment of Mr. Sereno Watson as Curator of the Herbarium in 1874.

His long residence and arduous labors at Cambridge were varied and relieved by several journeys, some of which were of considerable extent, and all of which were made to contribute to the advancement of work on the "Flora," either by enabling him to examine in the field the plants which he was studying, or by examination of foreign herbaria, and consultations with leading foreign botanists. He made three trips to California, in 1872, in 1877, when he was in company with Sir J. D. Hooker, and in 1885, when he visited not only Southern California and the great Colorado Cañon, but journeyed into Mexico as far as Orizaba and Cordoba. He was once in Florida, in 1875, and made, besides, several trips to the mountains of North Carolina, where he botanized at different times with his botanical friends, Sullivant, Carey, Engelmann, Canby, and Redfield.

He made in all six journeys to Europe, including the journey already mentioned and a short business trip of six weeks to Paris in the summer of 1855. On the other journeys he was accompanied by Mrs. Gray. When abroad, he always spent much of his time with the English botanists, among whom he counted many warm personal friends; and he looked forward with special pleasure to his visits at Kew, where he was welcomed by the Director, Sir W. J. Hooker, and by his son and successor, Sir J. D. Hooker, for forty years his intimate friend, whose opinion in botanical matters he esteemed more highly than that of any of his contemporaries. In his second journey, from June, 1850, to August, 1851, he travelled through France, Germany, and Holland, and spent two months with Bentham at his home in Herefordshire, studying the plants of the Wilkes Expedition, upon which he was then working. The fourth journey, from September, 1868, to November, 1869, was undertaken at a time when he was much overworked, and he spent the winter in Egypt, that country being almost the only spot where there was nothing to tempt him to botanize, besides visiting Italy, France, Germany, and England. The event of the journey of September, 1880, to November, 1881, was a trip to Spain, a country where he obtained much relief from botany.

His last journey, on which he started in 1887, was a triumphant farewell, in which were heaped upon him the honors bestowed on few naturalists. He visited friends in France, Austria, and Germany; stopped at Geneva to see De Candolle, his life-long friend, older by four years than himself, and sorrowfully bade him what both must have felt to be a last farewell; then hurried back from the Continent to receive the Doctor's degree from the three great British Universities, and to attend the meeting of the British Association at Manchester. Here he saw many old friends, and met for the first time three of Germany's most distinguished botanists, — Cohn, Pringsheim, and the lamented De Bary, whose untimely death was to come but a few days before his own. At Manchester he was brought into contact with a large number of young botanists, who were charmed with his genial manner, and astonished at his well preserved vigor of body, as well as mind. He returned to America in October, apparently in perfect health, and resumed active labor on the "Flora"; but while busied with the preparation of the *Vitaceæ* for that work, he was suddenly stricken with paralysis, on the morning of November 28, and lingered in a partially conscious condition until the evening of January 30, when he passed calmly away.

By the death of Asa Gray, this Academy has lost a member whose activity and zeal were unceasing, and whose brilliant talents as a scientific writer, not surpassed by those of any of the illustrious names on our roll, added much to the reputation of the society at home and abroad. Elected a Corresponding Member in 1841, he became an active member in 1842, on his settlement in Cambridge, and served as Corresponding Secretary from 1844 to 1850, and again from 1852 to 1863, and as President from 1863 to 1873. During this long membership of more than forty years, his attendance was always exemplary. The storms of winter and the inclemencies of spring, which kept younger men at home, did not prevent his coming from the remote Botanic Garden regularly to attend the meetings. Although an honorary member of most of the learned societies of this country, and of many of the most prominent societies of Europe, including the Royal Society of London, the French Academy, and the Imperial Academy of St. Petersburg, of which he was one of the very few Americans who have been elected corresponding members, this Academy was the society in which he felt the greatest interest, and was most at home.

There are few volumes of our Proceedings which do not contain important communications from his pen. One of the earliest of his works, the "Chloris Boreali-Americana," was printed in the third volume of the Academy's Memoirs, in 1846; and to subsequent volumes he contributed "Plantæ Fendlerianæ Novi-Mexicanæ," presented in November, 1848; "Plantæ Novæ Thurberianæ," and "Note on the Affinities of the Genus *Vavæa*, Benth., also of *Rhytidandra*, Gray," August and October, 1854; and a group of four papers, entitled "Botanical Memoirs," in 1859, including one "On the Botany of Japan, and its Relations to that of North America," — a remarkable essay on the geographical distribution of plants, which stamped the author as worthy to rank with the great botanists of the world. We need not enumerate his many papers which have appeared in the Proceedings of the Academy, for they alone would fill several volumes. It was his custom to embody the results of his preliminary studies on the North American flora in the form of notes on critical species, descriptions of novelties, and monographs of genera, and sometimes orders, of which by far the greater part first appeared in our Proceedings, usually under the heading of "Botanical Contributions," — a long and very valuable series, dating from the paper "On some New *Compositæ* from Texas," presented December 1, 1846, and ending with the posthumous "Notes upon some Polypetalous Genera and Orders," presented April 19, 1888. Nor should we forget the many biographical notices in which he commemorated the lives and works of others with an appreciating discrimination, written in a manner peculiarly his own.

The botanical department of Harvard University was practically created by Asa Gray. In 1805 a small Botanic Garden was established at Cambridge, under the auspices and by the aid of the Massachusetts Society for Promoting Agriculture, and William Dandridge Peck was appointed Director and Professor of Botany. In 1818 he printed a "Catalogue of American and Foreign Plants cultivated in the Botanic Garden, Cambridge," in which 1,309 species were enumerated; but the list included some common cryptogams found everywhere, and a large number of phænogamic shrubs and weeds, common natives of the region, hardly to be counted as legitimate members of a botanic garden. Professor Peck died in 1822, when, owing to the low state of the funds, a Professor was not appointed; but Thomas Nuttall, the well known botanist and ornithologist, was appointed Curator of the Garden, and, later, Lecturer on Botany. This amiable but very reticent naturalist — who apparently did not find his residence in Cambridge very congenial, for he describes himself as vegetating like his plants — resigned his position in 1833, and returned to Philadelphia. The Garden, such as it was, was then put under the charge of William Carter, a gardener, and the lectures on botany were given by T. W. Harris, the well known entomologist and Librarian of the College, and Dr. A. A. Gould of Boston. Not long before 1842 the directorship of the Garden was offered to Mr. George B. Emerson of Boston, who declined the position soon afterwards accepted by Dr. Gray in connection with the Fisher Professorship.

On Dr. Gray's accession there was no herbarium, no library, only one insignificant greenhouse, and a garden all in confusion, with few plants of value. In 1844 he moved into the house which had been built for Professor Peck in the Garden, and with his characteristic energy he soon brought together an herbarium and library, and arranged the Garden systematically. At the time of his marriage a small wing was added to the house, of which the lower story served as a study and herbarium until 1864. But the plants soon overran the limits of the herbarium, and finally the whole house was crammed with plants, — plants in the dining-room, in the attic, in the closets, and in the bedrooms; for whatever he could spare from a salary of $1,000 at first, and $1,600 afterwards, was spent on his herbarium and library. In 1864, dreading the danger from fire to a collection kept in a wooden house, he offered to present his collections to the College, on condition that a suitable building should be erected for their reception. Through the liberality of Mr. Nathaniel Thayer of Boston, a brick building to be used as an herbarium and library was erected in 1864, at a cost of $12,000; and, mainly through the agency of Mr. G. B. Emerson, a further sum of $10,000 was raised, the income of which was to be used in defraying the current expenses of the Herbarium. From a letter by Dr. Gray to the President of the University, dated November 20, 1864, and a notice in the American Journal of Science of March, 1865, we learn that the Herbarium then contained at least 200,000 specimens, and the library about 2,200 botanical works, not including a good many pamphlets. There was also a set of 335 very costly illustrated works, contributed by Mr. John A. Lowell.

Since 1864 the Herbarium has been constantly enlarged, principally by exchanges, of which those from the Kew Herbarium especially were of very great value; so that it is now probably twice as large as in 1864, and forms practically a National Herbarium, for it is by far the largest and most valuable herbarium in America, and is excelled in size by but few of the older and richer herbaria of Europe, as those at Kew, Paris, Berlin, the De Candolle Herbarium at Geneva, and possibly that at St. Petersburg. In the representation of the Phænogams of North America outside the tropics, it is probably unequalled by any herbarium except that at Kew. The library at the time of Professor Gray's death was roughly estimated to contain something over 5,000 volumes and 3,000 pamphlets, but these figures are probably too low. Many of the additions since 1864 are the gift of Dr. Gray. In building up this vast collection, he gave not only much of his time and thought, but also an actual sum of money, which comes well up in the thousands, and, to crown all, manifested his devotion to the welfare and perpetuation of the collection by bequeathing to the University for its support the royalties on his publications.

The Garden during his administration was improved by the addition of several greenhouses, in which were cultivated a choice selection of exotics, and the rather limited space of the Garden itself was filled with good representatives of the flora of the temperate regions, the collection of *Compositæ* being especially important. In the absence of a sufficient endowment, activity on the part of the Director had to replace the want of money, and he, utilizing the means at hand, succeeded in making the Garden an exceedingly important means of exchange between foreign establishments and our own botanists and collectors. European botanists who visited the Garden wondered how, from such a small and ill-endowed establishment, so much had been done in aid of other institutions. The explanation lay in the skill and energy of Dr. Gray himself.

Gray's work as a teacher extended over a period of more than fifty years, dating from the first lectures on botany at the Fairfield Medical School, in 1831 and 1832, and the publication of his "Elements of Botany," in 1836. During that period he trained up a whole race of botanists, now scattered through all parts of the United States, so that wherever he went he was greeted by those who remembered his instruction with pleasure. When at Santa Barbara in 1885, an elderly man, who seemed to be about his own age, introduced himself as a former pupil in his first class at Harvard. As a college lecturer he was not seen at his best, for his somewhat hesitating manner when he spoke extemporaneously was unfavorably contrasted with the fervid, almost impetuous utterance of Agassiz, and the clear exposition and dignified address of Jeffries Wyman, his two great contemporaries at Harvard. In his public addresses he always spoke from notes, and, especially in his later years, his strikingly expressive face commanded the attention of his hearers from the start. In the class-room he was personally much liked, and he made a strong impression on the majority of students, although, in the days when every student was forced to study botany, there were of course some who would not have cared for the subject under any circumstances. The instruction, as was natural, bearing in mind his own early training and the state of botany in this country at the time when he became Professor at Harvard, was confined mainly to the morphological study of flowering plants; for he recognized that, until some advance had been made in that direction, it was out of the question dealing adequately with the more technically complicated subjects of histology, embryology, and physiology.

For the instruction which he was obliged to give, the resources of the Garden and Herbarium and the ordinary college lecture-rooms at first sufficed, but at last it became necessary to provide a special laboratory and lecture-room at the Garden. A liberal friend of Dr. Gray and the College presented a sum of money for this purpose, and in 1872 a wing was added to the Herbarium. About this time the demand for laboratory instruction and equipment increased rapidly, and the new lecture-room and laboratory were soon found to be inadequate to meet the needs of the increasing calls for microscopic and physiological work, and they were at length abandoned. It is not surprising that Dr. Gray could not foresee how great the growth in this direction was to be, even in his own life. Probably no person of his age could have foreseen it.

His Herbarium was, at one period or another, the resort of nearly all the active working botanists of the country, and thither came many young men who were afterwards to aid in the development of botanical studies in the United States. His intercourse with them was always free and unrestrained by formalities of any kind, and he seemed more like a learned friend than a teacher. Passing to and fro from his own study to the Herbarium, he greeted all cordially,-watching and criticising sharply but good-naturedly the work that was going on. No one enjoyed a hearty laugh more than he, and every now and then he would brighten the work by some anecdote from the large stock which his retentive memory ever had at hand; always, however, for the purpose of emphasizing some point, or illustrating some fact which he wished to bring out more clearly, but never allowing the attention of those about him to be distracted from their work. Life at the Herbarium was indeed a pleasure, and the more serious work was well seasoned and spiced in the days when the agile assistant, Charles Wright, skipped about like a squirrel, his diminutive body in Cambridge, his larger mind wandering away in his beloved Cuba and the Pacific Islands, — when Brewer, less continent than his teacher in the matter of anecdote, saw in every plant before him some episode of his own life in camp. The approach of Dr. Gray, heralded by his cheery laugh, or perhaps by a mild anathema against the gardener, who every morning, regardless of the intentions of nature, deluged the Cacti placed in the corridor, we all understood to mean business, for, if joking was allowed, trifling was not. We learned something about botanists as well as about botany, and often wondered whether Robert Brown were really as great as he was represented; and, on the rare occasions of a visit from a man like Dr. Torrey or Dr. Engelmann, we asked ourselves whether there was any chance that the younger generation of botanists would bear any comparison with the older. None who have worked under Dr. Gray at the Herbarium will forget the deep personal interest he always manifested in their work and future prospects. He always encouraged and stimulated without holding out false hopes. To those who wished to devote themselves to botany in the years still recent, when it was scarcely possible for a botanist to live by botany alone, he used to say: "Study medicine, and if you then still want to be a botanist, go ahead. Your medicine will keep your botany from starving."

Great as was the direct influence of Dr. Gray upon the students with whom he came in contact, his influence on the development of botany in this country through the medium of his numerous text-books and manuals was even more important. His first text-book, "Elements of Botany," written when he was only twenty-six years old, shows many of the best characteristics of his later works, being written in a smooth, graceful style, with the different topics clearly and methodically arranged. The vigorous defence of the natural system of classification, which now appears superfluous, indicates that the author of 1836 was a progressive young man, who had shaken off the conservatism which prevailed among American botanists of that period. That he was young and inexperienced is occasionally shown, as in the amusing statement that "the herbarium of a diligent botanist will pass so frequently under his observation that any very extensive ravages [by insects] can hardly take place without his being aware of it in time to check the progress of the destroyers." He evidently had no conception of how large his own collection would become in a few years.

The "Elements" of 1836 developed into the "Botanical Text-Book" of 1842, in which the portion relating to systematic botany was much more fully treated than in the earlier volume. The later editions, which appeared at intervals until 1879, are familiar to every one, for they have been the means of opening the world of botany to more than one generation of American botanists. In 1868 the "Lehrbuch der Botanik," by Sachs, appeared. That work was a genuine revelation, showing the advance which had been made by experts in the science of botany, and, although somewhat above the capacity of the common student, it was destined to produce in a few years a revolution in the method of botanical instruction.

Recognizing the new era which had opened in botany, Dr. Gray revised the plan of the "Text-Book," with a view of bringing it into accord with the more widely developed science of the day, and in 1879 issued the first volume of the revised work, in which he included the Morphology of Phænogams, Taxonomy, and Phytography, thus covering the greater part of the ground of the original "Text-Book," intrusting to his colleague, Professor Goodale, the volume on Physiological Botany, which appeared in 1885 as worthy companion of its predecessor, and to the writer the volume on Cryptogams. He hoped, but hardly could have expected, to write a fourth volume, on the Orders of Phænogamous Plants. It is deeply to be regretted that he was never able to write this volume, for it would have enabled him to present the general views on classification derived from a long and exceptionally rich experience. No better text-book on the subject had ever been written in the English language than Gray's "Text-book" in the original form; and, although botanical instruction is now very different from what it used to be, it is still true that, as an introduction to the study of Phænogams, the group to which beginners naturally turn their attention, the later "Structural Botany" is likely to hold its own for some time to come.

In 1887, just before he started on his last European journey, he finished a small book giving in an abbreviated form the substance of the Structural Botany, as well as some chapters on Cryptogams; and for this his latest text-book he revived the title of his earliest work, "Elements of Botany."

The "Manual of the Botany of the Northern United States," of which the first edition appeared in 1847, needs no words of praise here. There are probably few members of the Academy who do not own, or have not at some time owned, a copy of this model work. Occasionally some over-wise person has discovered that certain plants grow a few inches taller or bloom a few days earlier than is stated in the "Manual"; but the botanist is yet to be born who could write a more clear, accurate, and compact account of the flora of any country. The only regret is that he could not have written manuals for all parts of the country.

Dr. Gray had the rare faculty of being able to adapt himself to all classes of readers. With the scientific he was learned, to the student he was instructive and suggestive, and he charmed the general reader by the graceful beauty of his style, while to children he was simplicity itself. The little books, "How Plants Grow," and "How Plants Behave," found their way where botany as botany could not have gained an entrance, and they set in motion a current which moved in the general direction of a higher science with a force which can hardly be estimated. His scientific friends, especially those abroad, sometimes blamed him for spending time in popular writing; but he may have understood himself and his surroundings better than they. With him botany was a pleasure, as well as a business. Few wrote as easily as he, and, so long as he spent most of his time in higher work, he certainly had a right to amuse himself with writings of a popular character if he chose. As it was, he interested a multitude of readers in the subjects which he had at heart, and if he was not permitted to live to see the completion of his greatest work, "The Synoptical Flora," he at least was able to leave the work at a point where it could be continued by a trusted friend, in sympathy with all his plans.

As a reviewer he was certainly extraordinary. Some of his reviews were, in reality, elaborate essays, in which, taking the work of another as a text, he presented his own views on important topics in a masterly manner. Others were technically critical, while some were simply concise and very clear summaries of lengthy works. Taken collectively, they show better than any other of his writings the literary excellence of his style, as well as his great fertility and his fairness and acuteness as a critic. Never unfair, never ill-natured, his sharp criticism, like the surgeon's knife, aimed not to wound, but to cure; and if he sometimes felt it his duty to be severe, he never failed to praise what was worthy. The number of his reviews and notices written during his connection with the American Journal of Science as editor and assistant editor for over thirty years, and for the North American Review, the Nation, the Atlantic Monthly, and numerous other journals, is enormous, and it almost seems as if he must have written notices of the greater part of all the botanical works he had ever read. Those intimately acquainted with him more than half believed that he was able to write good notices of books written in languages which he could not read. He was able, as if by instinct, to catch the spirit and essence of what he read, without any exertion on his part. One who wrote so much might have become monotonous. But he was never prosy, and his style was so easy and flowing, and so constantly enlivened by sprightly allusions and pleasing metaphors, that one could read what he wrote for the mere pleasure of the reading. His was one of the rare cases where Science had appropriated to herself one who would have been an ornament to any purely literary profession.

It would be presumption were we to express an opinion on the position of Gray as a scientific botanist. Fortunately for us, it is unnecessary. The greatest living systematic botanist, Sir J. D. Hooker, the one by his attainments and position fitted above all others to speak with authority on the subject, has already recorded his opinion in the following words: —

> "When the history of the progress of botany during the nineteenth century shall be written, two names will hold high positions: those of Professor Augustin Pyrame De Candolle and of Professor Asa Gray. . . . Each devoted half a century of unremitting labour to the investigation and description of the plants of continental areas, and they founded herbaria and libraries, each in his own country, which have become permanent and quasi-national institutions. . . . There is much in their lives and works that recalls the career of Linnæus, of whom they were worthy disciples, in the comprehensiveness of their labour, the excellence of their methods, their judicious conception of the limits of genera and species, the terseness and accuracy of their descriptions, and the clearness of their scientific language."

The accuracy of the resemblance of Gray and De Candolle, so admirably and justly expressed by Hooker, will be recognized by all botanists.

Gray was the De Candolle of America, whose mission it was to bring together the scattered and crude works of the earlier explorers and botanists and the vast unwrought material of his own day, and to combine them with his surpassing skill into one grand comprehensive work which should fitly describe the flora of a continent. But while recognizing the resemblance between De Candolle and Gray in their mode of work and the purpose for which they strove, we can only marvel how it was possible for a poor farmer's boy in America, without a university education, to become the peer of one of Europe's best trained botanists.

From his training and early surroundings we might have expected him to be energetic and original, but we should not have expected to find him highly polished and cultured. His associates at Fairfield and Clinton were persons of scientific tastes, and, even if their attainments were not of the highest quality, they encouraged his fondness for natural history. But it is not easy to see how he obtained the literary training which enabled him to write with the ease and elegance found even in his earlier works, for although a man may by nature be a good observer of natural objects, a finished style comes only with training and experience. From his teacher, Avery, he could not have received much in the way of training; for Dr. Gray himself says that he did not give him the sharp drilling and testing which was needed. His residence with the Torrey family in New York first placed him in a society where literary excellence as well as scientific knowledge was prized; and while he profited by the accuracy and strict scientific methods of Dr. Torrey, then the foremost American botanist, the frequent conversations and kindly criticisms of Mrs. Torrey made good many of the literary deficiencies of his early training. He was also aided while in New York by the criticisms and suggestions made on some of his earlier manuscripts by the cultured botanist, Mr. John Carey. But he must have been an apt pupil, for, while still with Dr. Torrey, he showed that in point of clearness and accuracy he was not much inferior to his highly respected teacher, and in the second volume of the "Flora" he proved himself to be quite his equal.

The plan of the "Flora of North America" originated with Dr. Torrey; but when his pupil went to Cambridge to assume the duties of his new position, neither of them suspected the magnitude of the task which they had undertaken, nor the modifications which the plan must ultimately undergo. The pupil was now in a more fortunate position than his teacher, for Gray was henceforth able to devote himself to his favorite science, while Dr. Torrey could only employ his leisure hours in botany. The two volumes of the original Torrey and Gray "Flora" will always remain a memorial of the unbroken friendship of America's two greatest botanists, alike in the spirit which animated their work and in the reverent simplicity of their characters.

The greater part of Gray's scientific work during the thirty-five years following the completion of the second volume of Torrey and Gray's "Flora," in 1843, had a more or less direct bearing on the contemplated revision and enlargement of that work. Besides the papers printed in the Academy's publications, he wrote a very large number of monographs and notes on points connected with the determination and description of new and doubtful species. They are scattered through the proceedings of different learned societies, and the columns of the American Journal of Science, the Torrey Bulletin, Botanical Gazette, the Naturalist, and other American, as well as European journals. One of his most important works was "Genera Floræ Americæ Boreali-Orientalis Illustrata" (1848–49), in which he intended to figure and describe all the genera of the Eastern States, with the aid of the artist, Mr. Isaac Sprague. Of this work only two of the proposed volumes were ever published, owing to the expense entailed. Other important papers were "Plantæ Wrightianæ Texano-Neo-Mexicanæ," in the Smithsonian Contributions of 1852 and 1853; "Plantæ Lindheimerianæ," written in connection with Dr. Engelmann; "Reports on the Botany of the 32d, 38th, 39th, and 41st Parallel Expeditions," in connection with Dr. Torrey; *Gamopetalæ* in Watson's Flora of California, etc. An examination of the complete list of his works, which will soon be printed in the American Journal of Science, would alone convey any adequate idea of his extraordinary fertility as a writer, and the wide range of his investigations.

After this long preparation of thirty-five years, the first part of the "Synoptical Flora," including the *Gamopetalæ* after *Compositæ*, appeared, in 1878. It formed the first part of the second volume; for, on the revised plan, the first volume was to include the *Polypetalæ* and *Gamopetalæ* through *Compositæ*, and the second volume the remaining Exogens and the Endogens. A second part, including from *Caprifoliaceæ* through *Compositæ*, appeared in 1884, and in 1886 supplements to both parts were issued, and the whole bound in one volume. He was at work on the *Polypetalæ*, and had nearly finished the *Vitaceæ*, when attacked by his last illness, and the unfinished volumes must now be completed by him who was his associate for many years, and, after Dr. Gray himself, the best fitted for the work.

Gray's critical knowledge of the Flora of North America not only placed him at the head of all American botanists, but also gave him a high reputation abroad. In his knowledge of the difficult order *Compositæ*, the largest of all the orders of flowering plants, and the one in which he always felt the most interest, he probably surpassed any living botanist. He was at one time urged by Bentham and Hooker to treat that order in their classic " Genera Plantarum," but, as the work involved a residence at Kew for a considerable time, he was obliged to decline the offer.

It was, however, more especially through his observations on the geographical distribution of plants made incidentally during the progress of his work on our own flora, that he was recognized as a naturalist of the highest type by the scientific circles of Europe. When we consider the marked capacity for studies of this nature which he afterwards exhibited, remembering the brilliant contributions to Plant Geography which resulted from the explorations of Robert Brown, Darwin, and Hooker, we can only regret that Gray did not sail as botanist of the Wilkes Expedition. The collectors of the expedition, Dr. Charles Pickering, W. D. Brackenridge, and William Rich, brought back many interesting plants, of which the Phænogams, excepting those from the Pacific Coast of America sent to Dr. Torrey, were placed in his hands for description. But Gray would have been more than a collector. He would have brought back impressions, and, recalling the charming narrative of the illustrious naturalist of the Beagle, we can imagine the pleasure with which we should have read the journal of a botanist, written with the delicate humor and the keen appreciation of the beautiful and curious in nature which Asa Gray possessed.

The study of the Wilkes plants, in which he was aided by Bentham's large experience, gracefully acknowledged in his Memorial of Bentham in the American Journal of Science of February, 1885, introduced him to an exotic flora of large range. The work appeared in 1854 as a quarto volume of nearly eight hundred pages, with an atlas of a hundred folio plates.

His first* paper on the distribution of plants appeared in the American Journal of Science of September, 1856, and was followed by two other parts the next year. It bore the title of " Statistics of the Flora of the Northern United States," and was prepared at the time he was at work on a second edition of the "Manual," partly in response to a request from Darwin for a list of American alpine plants. In this paper he gave a general view of the characteristics of the North American flora, with tables of species showing the extension of alpine plants, and the comparative distribution of Eastern and Western species, and their relation to species of Europe and Asia, although he states that he must defer making an extended comparison with the plants of Northeastern Asia until he has studied some recent collections from the northern part of Japan. The most important conclusions reached in this paper may be stated in his own words: "All our strictly subalpine species (with two exceptions) which are common to us and to Europe, extend northward along the central region of the continent quite to the arctic sea-coast. While curiously enough, eleven, or one third of our strictly alpine species common to Europe, — all but one of them arctic in the Old World, — are not known to cross the arctic circle on this continent. This, however, might perhaps have been expected, as it seems almost certain that the interchange of alpine species between us and Europe must have taken place in the direction of Newfoundland, Labrador, and Greenland, rather than through the polar regions." Again: "The special resemblance of our flora to that of Europe, it is clear, is not owing simply either to the large proportion of genera in common, or to anything striking or important in the few genera nearly or quite peculiar to the two. The latter, indeed, are insignificant in our flora, and not to be compared, as to any features they impart, with the much more numerous and really characteristic genera which are shared by the Eastern United States and Eastern temperate Asia. We must look for it in the species, partly in the identical ones, and partly in those which closely answer to each other in the two floras." He accounts for such cases as the occurrence of *Phryma Leptostachya* in the United States and Nepal as follows: "We should therefore look in one and the same direction for the explanation of these extraordinary no less than of the more ordinary cases of distribution, and . . . should refer such anomalous distribution to very ancient dispersion."

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* In the paper " On the Botany of Japan," p. 442, Gray speaks of a paper on the distribution of plants in the American Journal of Science of an earlier date than the one here mentioned, but the writer is unable to identify the paper in question.

The plants from Japan to which he referred were collected by Charles Wright, botanist of the North Pacific Exploring Expedition, known as the Ringgold and Rodgers Expedition, of which Dr. Gray gave an account in a paper "On the Botany of Japan, and its Relations to that of North America, and of other Parts of the Northern Temperate Zone," presented to this Academy, December 14, 1858, and January 11, 1859, and published, April 25, 1859, in the sixth volume of the Memoirs. This memoir raised his reputation to its highest point among scientific men, and, appealing again to the authority of Sir J. D. Hooker, " in point of originality and far-reaching results was its author's *opus magnum.*" In referring to his previous paper in the American Journal, he states with great candor, that, from the facts there brought out, — " 1. that a large percentage of our extra-European types are shared with Eastern Asia; and 2. that no small part of them are unknown in Western North America," — Mr. Bentham was the first to state the natural conclusion that the interchange between the temperate floras even of the western part of the Old World and of the New, has mainly taken place via Asia. He cites Bentham's suggestion of a continuity of territory between America and Asia, "under a latitude, or at any rate with a climate, more meridional than would be effected by a junction through the chains of the Aleutian and the Kurile Islands." He then proceeds to show why a connection in a more meridional latitude need not be assumed; and, fortified by the wide geological knowledge of his friend, Prof. J. D. Dana, he gives a masterly account of the relations of the floras of the North Temperate regions from the Cretaceous period to the present time, accounting for the present distribution by migrations of species from the Arctic regions due principally to the different climatic conditions of the pre-glacial, glacial, and post-glacial eras. The relations of the floras of Eastern America and Eastern Asia was a favorite topic with him, and he often spoke on the subject in public; his two most important addresses in which he referred to plant distribution being that on " Sequoia and its History," delivered as retiring President of the American Association for the Advancement of Science in 1872, and a lecture on " Forest Geography and Archæology," read before the Harvard Natural History Society in 1878, and afterwards translated in the Annales des Sciences.

The study of plant distribution necessarily involved the question of the origin of species, and this brings us to a consideration of the relations of Gray to Darwin and Darwinism. Gray first met Darwin at Westbank, the residence of Sir W. J. Hooker at Kew, in 1851; and their correspondence dates from a letter of Darwin written April 25, 1855, asking for information about the alpine plants of the United States. How intimate and frequent their correspondence became, and how deeply each was interested in the work of the other is admirably shown in the " Life and Letters of Charles Darwin." The published letters present a vivid picture of the inner scientific life of these two men, — both equally simple, earnest, remarkably free from prejudice, and anxious to do justice to the work of others. Many of the problems upon which Darwin was at work were those in which Gray was most interested; and he was often able to aid Darwin by his observations, and still more by his judicious and always acceptable criticisms. While the naturalist at Down was absorbed in the study of climbing plants and cross-fertilization, the greenhouses at Cambridge were also used as nurseries for the growth of climbers, and the odd, irregularly flowered plants which ought to be cross-fertilized. The writer recalls the time when Dr. Gray hardly ever passed in or out of the Herbarium without stroking — patting on the back by way of encouraging them it almost seemed — the tendrils of the climbers on the walls and porch; and when, on the announcement that a student had discovered another new case of cross-fertilization in the Garden, he would rush out bareheaded and breathless, like a schoolboy, to see the thing with his own critical eyes.

Darwin, in a letter dated July 20, 1856, confided to Gray that he had "come to the heterodox conclusion that there are no such things as independently created species, — that species are only strongly defined varieties." In this letter he also says, "I *assume* that species arise like our domestic varieties with *much* extinction." About a year after this, September 5, 1857, Darwin wrote to Gray the now famous letter, in which he propounded the law of the evolution of species by means of natural selection; and it was this letter, read at the Linnean Society, July 1, 1858, on the occasion of the presentation of the joint paper of Darwin and Wallace, "On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection," which fixed the date of the priority of the great discovery as due to Darwin. What were Gray's own views on the subject of evolution previous to the publication of the "Origin of Species," in November, 1859, may perhaps be inferred from some remarks which he made on January 11, 1859, when he presented his paper "On the Botany of Japan" to this Academy. He then stated that "the idea of the descent of all similar or conspecific individuals from a common stock is so natural, and so inevitably suggested by common observation, that it must needs be first tried upon the problem [of distribution], and if the trial be satisfactory, its adoption would follow as a matter of course." In brief, he was inclined to accept evolution, but wished more proof; and nearly three years earlier, in a letter to Professor Dana, written December 13, 1856, he had well expressed his own attitude by saying, "I have as yet no *opinion* whatever, and no very strong *bias*." He saw what was coming, however, and in a later letter to Professor Dana, anticipating the publication of the "Origin of Species," he says, "You may be sure that before long there must be one more resurrection of *the development theory* in a new form, obviating many of the arguments against it, and presenting a more respectable and more formidable appearance than it ever has before."

Gray was one of the favored three, including Hooker and Lyell, to whom Darwin sent advance sheets of the "Origin of Species" prior to its publication in November, 1859; and of his review in the American Journal of Science of the following March, Darwin wrote, "Your review seems to me admirable, — by far the best I have read." The review certainly presents most accurately, succinctly, and attractively Darwin's own views; but Gray does not even here announce that he is himself a complete convert to the doctrine, as is seen by the following citation: "What would happen if the derivation of species were to be substantiated, either as a true physical theory, or as a sufficient hypothesis? The inquiry is a pertinent one just now. For, of those who agree with us in thinking that Darwin has not established his theory of derivation, many will admit with us that he has rendered a theory of derivation much less improbable than before; that such a theory chimes in with the established doctrines of physical science, and is not unlikely to be largely accepted long before it can be proved." And the similar statement in the Atlantic Monthly of October, 1860: "Those, if any there be, who regard the derivative hypothesis as satisfactorily proved, must have loose notions of what proof is. Those who imagine it can be easily refuted and cast aside must, we think, have imperfect or very prejudiced conceptions of the facts concerned and of the questions at issue."

In 1876 he brought together in a volume, entitled "Darwiniana," his principal essays and reviews pertaining to Darwinism, taken from the American Journal of Science, the Nation, and the Atlantic Monthly, and added a chapter on "Evolutionary Teleology"; and in 1880 he published "Natural Science and Religion," two lectures delivered to the Theological School of Yale College, before a critical audience, who listened with the deepest interest to what was, in some points, his most advanced view of natural selection. We need not dwell on a subject about which so much has lately been written by far abler pens than ours. Briefly stated, Gray was probably the best expounder of Darwinian principles, — meaning thereby those actually advocated by Darwin himself, and excluding the wild deductions attached to the original theory by those who deserve the name of Darwinissimists rather than Darwinists, — although he himself regarded natural selection as a less efficient cause than it was assumed to be by Darwin.

His influence as an exponent of Darwinism was due partly to the admirable clearness and candor of his reviews, and his interesting way of putting things; for his fertile imagination was constantly discovering apt similes to illustrate otherwise dry arguments. It was also due in part to his known caution and conservatism, and his professed Christian faith. If an avowed accepter "of the creed commonly called the Nicene" saw nothing in Darwinism which implied atheism, or was opposed to the idea of design on the part of the Creator, surely one might, at least, listen to his account of the development theory with safety. To his hearers at New Haven, in 1880, he said: "Natural selection by itself is not an hypothesis, nor even a theory. It is a truth, — a *catena* of facts and direct inferences from facts. . . . There is no doubt that natural selection operates; the open question is, what do its operations amount to. The *hypothesis* based on this principle is, that the struggle for life and survival of only the fittest among individuals, all disposed to vary and no two exactly alike, will account for the diversification of the species and forms of vegetable and animal life, — will even account for the rise, in the course of countless ages, from simpler and lower to higher and more specialized living beings." He gave it as his opinion that natural selection is, on the whole, a good working hypothesis, but does not explain how wholly new parts are initiated, even if the new organs are developed little by little. He repeated over and over again in different reviews his belief that natural selection could not account for variation, and he stated the case particularly forcibly in his "Evolutionary Teleology": "Natural selection is not the wind which propels the vessel, but the rudder which, by friction, now on this side and now on that, shapes the course. The rudder acts while the vessel is in motion, effects nothing when it is at rest. Variation answers to the wind. . . . Its course is controlled by natural selection. This proceeds mainly through outward influences. But we are more and more convinced that variation . . . is not a product of, but a response to, the action of the environment. Variations are evidently not from without, but from within."

But how do variations arise? According to Gray, by virtue of some inherent power imparted in the beginning by Divine agency. That granted, natural selection would in great part account for the present condition and distribution of life, so that one could be a Darwinian and Deist at the same time. Gray further believed that variation is apt to follow in certain more or less regular directions, and particularly in beneficial directions. Here he differed very widely from Darwin. The one saw design where the other could not, and it must be confessed that Gray was treading on delicate ground, scientifically if not theologically speaking, when he affirmed the direction of variation in beneficial lines. For what is meant by beneficial? Beneficial to whom? Beneficial for what purpose? In one sense, any variation which tends to enable a living being to survive in the struggle for existence is beneficial; and to say that any being or structure has survived is the same as saying that the variation from which it sprang was beneficial. But Gray apparently uses the word beneficial in the sense of being foreordained to be beneficial.

Perhaps we must look to inheritance itself for an explanation of the difference in the views of Gray and Darwin. The Gray family were devout members of the Presbyterian Church, and throughout his life Dr. Gray adhered faithfully to the orthodox faith of his fathers, his own views being in harmony with those of the liberal branch rather than with those of the conservative branch of that communion. The agnostic position of Darwin may perhaps be inferred from his own description of himself and his father as belonging "nominally to [the] Church of England," an expression which leads one to believe that he was hardly to be counted a member of that or any other denomination. When a young man, Gray certainly had no leanings towards evolution. In his review of the " Vestiges of Creation," in the North American Review of 1846, he wrote: " Although 'geology fully proves' that there have been various creations, that different species were created at different periods, and that some of the humblest and simplest first appeared, while land animals, quadrupeds, quadrumana, and bimana were not introduced until after the earth was fitted for their residence, yet we are still to be convinced that they were not *then* created as perfect as they now are." But he was convinced later, when he studied the relations of the North American flora to that of Asia, and he accepted without hesitation the view that the present species are not special creations, but derived from previously existing species at a time when the truth of the theory was scarcely recognized by any naturalists, and at a date when in the public mind a belief in evolution meant atheism. He had the courage to avow openly his convictions, but, on the other hand, never allowed his convictions to be governed by wild speculations.

But we who have known Asa Gray so many years would now recall, not the great botanist, but rather the kind-hearted, genial man, whose sympathy cheered and whose wisdom guided, — whose heart was ever young, whose brain was ever active. His long life, unclouded by great sorrow and almost free from personal enmities, was inspired throughout by a faith which never faltered. Retaining to the last the energy and vivacity of youth, his intellect broadening and ripening, his character growing more and more sweet and serene, he reminds us of one of those trees which bear flowers and fruit at the same time. Industrious to an extent that few could equal, his work done, he enjoyed society with a relish, and his ready wit, his inexhaustible stock of anecdotes, and his quick and keen appreciation of the best in literature and art, made him everywhere welcome. His own house was open to all, and even those who came to pay the simple tribute of staring were not often turned away. With a graceful hospitality to which wealth could have lent no greater charm, he entertained the learned of many nations, and welcomed with special cordiality his brother botanists, a long array, including not only the experts in the science, but the poor and struggling student as well. He shared with all the treasures of his knowledge, and, not infrequently, he added something from the modest competence which his industry had amassed. The words of good cheer from his lips were re-echoed in after years, and the life so honorable was not unhonored. If the numerous honorary degrees from learned societies at home and abroad testify to the esteem in which he was held as a scientific botanist, the warm congratulations of friends from all parts of the country when the memorial vase was presented on his seventy-fifth birthday show no less clearly how much he was beloved as a man. And when, during dreary weeks, his anxious friends hoped against hope, watching to catch the sound of the loved voice which would speak but could not, all felt that the message which he sought to utter must have been a benediction. But it was not needed. His life was a benediction, and, as his body was borne to its last resting place, the freshly fallen snow was not more pure than his character, nor the sparkling winter air more bright and clear than his intellect.

LAURENS PERSEUS HICKOCK.

Laurens Perseus Hickock, D.D., LL.D., was born at Danbury, Connecticut, December 22, 1798, and died at Amherst, May 7, 1888. He graduated at Union College in 1820, then studied divinity, and served two short pastorates in his native State. In 1836 he became Professor of Theology in the Western Reserve College, Ohio. In 1844 he removed to Auburn, New York, to take a professorship in the Theological School. In 1852 he was elected to the Professorship of Mental and Moral Philosophy in Union College, and at the same